CHAPTER IV

IV Monitoring Program, Scope & Methodology

A. Morphological Data

Mendums Pond was formed during glacial modification by advance and recession of the ice sheet (Freedman, 1980). The construction of a bathymetric map aided in determining the morphological data (Figure III-1). To determine bathymetry, several transects were set up across the lake. A Humminbird LCR 3000 fathometer (NHDES, 1989), was utilized to compile hundreds of depth soundings. Contour lines were drawn at five foot intervals.

B. Station Locations & Descriptions

Tributary sampling locations were selected to include all the major inlets and outlets. A brief description of each station is presented in Table IV-1. The lake quality monitoring station was established at the deepest part of Mendums Pond (14.8m) and sampled at three depths: 2.0, 5.0 and 10.0m. Figure IV-1 depicts both the tributary locations and the in-lake sample site.

C. Field Procedures

1. Lake Field Procedures

The lake station was sampled monthly from July, 1987 through November, 1989. Temperature and dissolved oxygen were measured at one meter intervals using a YSI model 57 oxygen meter. Temperature was recorded to the nearest 0.1 degrees celsius. Dissolved oxygen was recorded to the nearest 0.1 mg/L.

Water samples were collected with a Wildco Kemmerer water sampler. Samples were preserved for nutrient analysis when appropriate. All samples were stored in a cooler and returned to the State Water Quality Laboratory in Concord, New Hampshire for analysis.

Transparency was measured to the nearest 0.1 meter using a 20 cm diameter Secchi disc with alternate black and white quadrants. Net phytoplankton and zooplankton were collected by hauling a Wisconsin 80 micron-mesh net from the thermocline. One sample was preserved in the field

Table IV-1

Description of Sampling Stations

Station #	Site Name	Site Description
1	Wood Road Brook	Above culvert (Al Wood Road)
16	Storm Brook	Below culvert (driveway)
2	Perkins Brook	Above rock dam
5	Howe Brook	Above culvert (McDaniel Shore Rd)
6	Howe Brook II	Below culvert (McDaniel Shore Rd)
3	McDaniel Brook	Above inflow of Golden Brook
4	Golden Brook	Below culvert (McDaniel Shore Rd)
7	Powerline Brook	Before entry to Mendums Pond
17	Seasonal Brook	Before entry to Mendums Pond
8	Little Powerline Brook	Before entry to Mendums Pond
10	Little Bridge Brook	Below bridge at UNH Rec. Area
9	Bridge Brook	Above bridge at UNH Rec. Area, then upstream from bridge*
11	Dam	Outflow stream from dam
12	Spillway	Immediately above spillway

*Blow-down from a severe rain storm (7/16/88) required relocation of sample site.

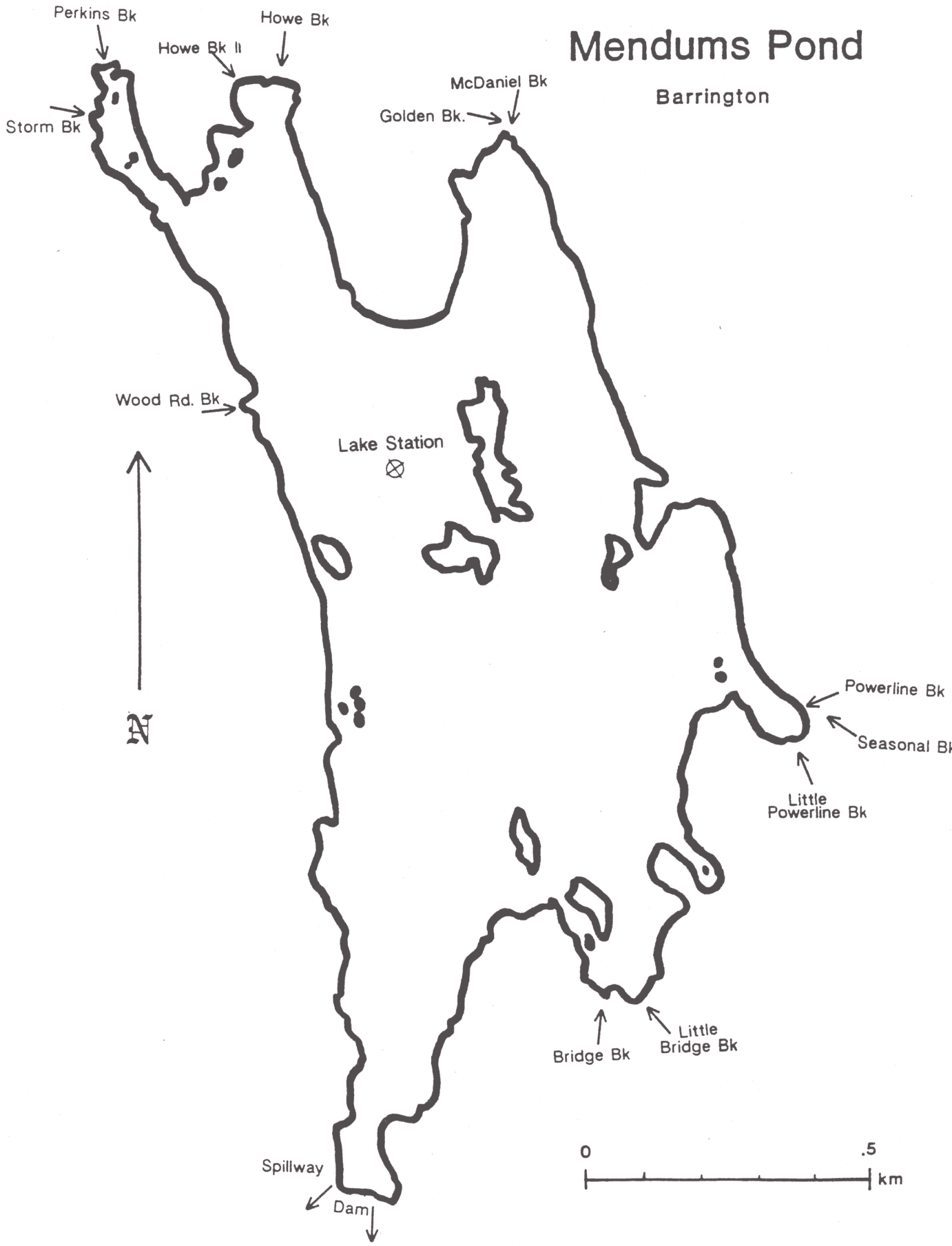


Figure IV-1 Sampling Station Locations

with Lugol's solution to determine plankton abundance. A second sample was returned live to aid in identification. Whole water phytoplankton for inverted scope density counts and chlorophyll-a samples were collected with an integrated sampler (weighted tube, 1" ID).

2. Stream Field Procedures

The tributary stations were sampled bi-weekly from October, 1987 through August, 1990. Staff gage measurements were recorded each sampling trip. Flow measurements were taken using a Marsh McBirney flowmeter to determine discharge in cubic feet per second (C.F.S.) at each station. Discharge was measured weekly.

3. Groundwater Seepage Field Procedures

Seepage meters were constructed using the top and bottom thirds of 55 gallon drums (Connor, 1979). A cork with rigid tubing was inserted into the flat portion so that a plastic whirl pack, cork and tubing could be attached (see Figure VII-2). After one hour, the plastic whirl packs were removed, and amount of seepage was measured and recorded.

An interstitial porewater sampler was used to collect groundwater for chemical analysis. See Figure IV-2 for a description of this specialized sampler.

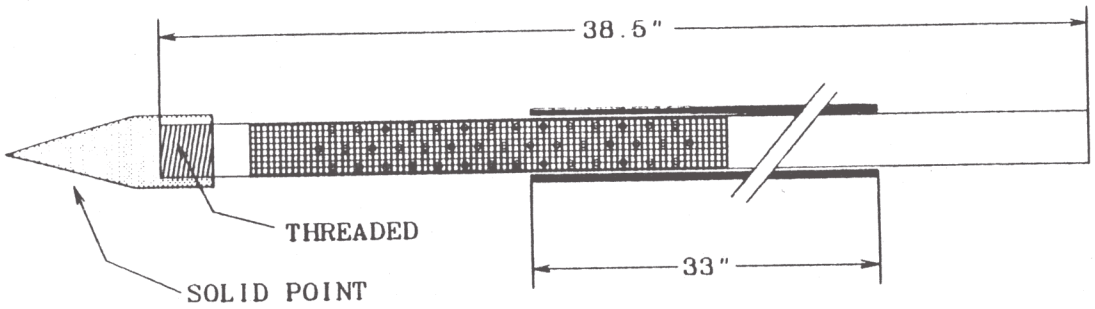
4. Periphyton Field Procedures

Periphyton sample stations were selected in two locations along the proposed development shoreline. Five other stations were selected in areas of previously developed shoreline and in areas of little or no development. See Figure VI-1 and Table VI-3 for station locations and descriptions.

Standard 25 x 75mm glass microscope slides were used as artificial substrate. These were inserted into WILDCO periphyton sampler frames which hold 8 slides in a floating rack. The frames were suspended approximately 0.5m above the bottom of the pond and about 1 meter below the water surface. They remained in the lake for approximately two weeks.

INTERSTITIAL PORE WATER SAMPLER

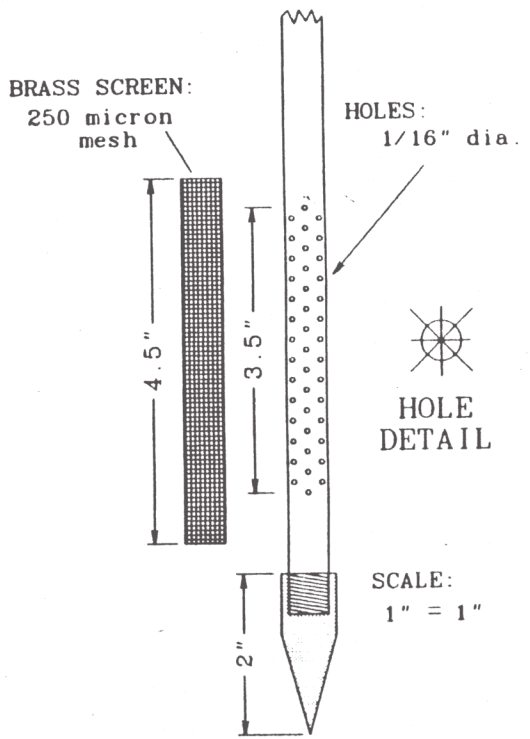
INNER/OUTER SLEEVE DETAIL



SECTION:

INSIDE TUBE:
5/16" ID; 1/2" OD
OUTER TUBE:
9/16" ID; 11/16" OD

SCALE: 1" = 1"



POINT DETAIL

D. Laboratory Methodology

1. Chemical and Physical

a. Temperature

Temperature was measured to the nearest 0.1°C utilizing a YSI model 57 oxygen meter and attached thermister. Winter lake temperatures were determined in the field using a thermometer.

b. Turbidity

Turbidity in water is caused by the presence of suspended or colloidal particles of clay, silt, organic matter, and algal cells.

As light passes through the water, it is scattered, reflected or absorbed by particulate matter in suspension. The amount of light reflected at a 90° angle is directly proportional to the amount of particular matter suspended in the water. This reflected light is measured by a turbidimeter. Turbidity is recorded in Nephelometric Turbidity Units (NTU), and is compared to previously reported formazin turbidity Units (FTU) and Jackson Turbidity Units (JTU).

c. Dissolved Oxygen

Winter dissolved oxygen samples were fixed in the field and oxygen was determined using the alkalide-azide Winkler modification (STD Methods 1989, 4500-OC).

d. Specific Conductance and Chlorides

Specific conductance is a measure of the capacity of water to conduct electricity. Specific conductance was measured to the nearest umhos/cm using a Leeds and Northrup Conductivity meter.

Chlorides were determined using a Dionex liquid chromatograph (E.P.A. Method #300.0).

e. pH and Alkalinity

pH was measured with a Fisher Acumet Model 825 or a Beckman pH meter to the nearest 0.01 pH units. pH meters were calibrated utilizing both a 4.00 and a 7.00 standard buffer solution .

Acid neutralization capacity (A.N.C.) or alkalinity refers to the capacity of a solution to neutralize or buffer acidic inputs. A.N.C. was determined by the gran plot titration technique (Std Methods #2320).

f. Phosphorus

Total phosphorus was measured by the persulfate digestion procedure (E.P.A. Method #365.2), and includes all phosphorus forms in water. Total phosphorus is composed primarily of organic phosphorus, which includes phosphorus present in the algal cells, and inorganic orthophosphate.

g. Nitrogen

Nitrogen may be present in water as dissolved nitrogen gas, organic nitrogen compounds, or inorganic nitrogen compounds including ammonia, nitrite, and nitrate. With the exception of some blue-green algae that utilize atmospheric nitrogen (N_2), most algae use inorganic nitrogen. Nitrates were determined by ion chromatography (E.P.A. Method #300.0). TKN was determined by using the colormetric semi-automated block digestion technique. (E.P.A. Method #351.2)

h. Color

The apparent color was measured by visual comparison of the sample with known concentrations of colored solutions. The platinum - cobalt method of measuring was used (Std Methods #2120) with the unit of color being that produced by 1 mg platinum/L in the form of the chloroplatinate ion. Different concentrations of chloroplatinum units were set up and used as standards for comparison. The samples were not filtered or centrifuged and thus turbidity was not accounted for.

2. Biological

a. Chlorophyll-a

Chlorophyll-a, a measurement of algae biomass, was collected by a integrated composite sampler through the water column to the mid-metalimnion. Samples were filtered through membrane filters, extracted in acetone for 24 hours in the dark, and measured spectrophotometrically (STD Methods #10200).

b. Phytoplankton

Phytoplankton and zooplankton collected in plankton nets (80 micro mesh net) were identified to genus, and the relative abundance of each genus was computed. Zooplankton were also counted (cells/Liter), whereas chlorophyll-a values were utilized for estimating algal biomass. The plankto were identified on a phase-contrast microscope using a Sedgwick-Rafter cell and Whipple disk. Phytoplankton collected as a subsample of the whole water composite were identified to genus and counted (cells/mL and percent). The whole water plankton were identified on an Inverted Microscope using a settling chamber. Analytical procedures are outlined in Methods for Chemical Analysis of Water and Wastes, 1974 Edition, EPA-625/16-74-003a. Reference ca also be made to the 14th edition of Standard Methods.

c. Periphyton

Methods of collecting and analyzing periphyton populations were obtained from Std Methods (APHA 1988) (Method #10300 A, B, C) . Glass slide were used for artificial substrates in the periphyton analysis. Eight slide per station were used, four slides for dry and ash-free weights, and four fo chlorophyll-a determinations. The dry and ash-free weight slides were dried in the field and rehydrated in the laboratory with de-ionized water.
Scrapings

were put into separate prewashed, prefired, tared crucibles, dried to constant weight at 105°C, cooled in a desiccator and weighed. They were then ignited for 1 hour at 500°C.

The mean weight from the slides is reported as dry weight and ash-free weight per square meter of exposed surface (for 2 25x75mm slides):

$$g/m^2 = \frac{g/slide\ (average)}{0.00375}$$

The chlorophyll content of attached communities is a useful index of the phytoperiphyton biomass. To determine chlorophyll concentration, individual microscope slides were placed into 100mL of a mixture of 90% aqueous acetone and 10% saturated $mgCO_3$ solution while in the field. They were then submerged in crushed ice, kept in the dark and frozen until processed.

The samples were removed from the freezer and centrifuged to extract pigment. The extract was transferred to a 1cm cuvette and the optical density (OD) was measured at 750, 664, 647 and 630nm.

The OD readings at 664, 647 and 630nm were used to determine chlorophyll a, b, and c, respectively. The OD reading at 750nm is a correction for turbidity, and was subtracted from each of the pigment OD values of the other wavelengths before calculating:

$$C_a = 11.85\ (OD664) - 1.54\ (OD647) - 0.08\ (OD630)$$
$$C_b = 21.03\ (OD647) - 5.43\ (OD664) - 2.66\ (OD630)$$
$$C_c = 24.52\ (OD630) - 7.60\ (OD647) - 1.67\ (OD664)$$

where:

C_a, C_b, and C_c = concentrations (ug/L) of chlorophyll a, b, and c

OD664, OD647, OD630 = corrected optical densities (with a 1cm light path) at the respective wavelengths.

The amount of pigment per unit surface area of sample is calculated as follows:

$$mg\ chlorophyll\ a/m^2 = \frac{Ca \times volume\ of\ extract,\ L}{area\ of\ substrate,\ m^2}$$